THE CLAIMS

What is claimed is:

1. A method of producing a crystal, comprising:

arranging and associating a plurality of layer segments of a first monocrystalline material on a first substrate to form an assembled layer comprising the segments; and

growing a layer of monocrystalline material on the assembled layer using the layer segments as seed material to form a grown monocrystalline material as the crystal.

2. The method of claim 1, wherein the grown monocrystalline material is the same material as the first monocrystalline material.

3. The method of claim 1, wherein the grown monocrystalline material is of a different monocrystalline material that is compatible with the first monocrystalline material.

4. The method of claim 1, wherein the layer segments comprise films.

5. The method of claim 1, wherein the first substrate has a face on which the assembled layer is disposed, the face having a width of at least about 100 mm and a surface area of at least about 75 cm^2.

6. The method of claim 1, wherein the layer segments are bonded to the first substrate.

7. The method of claim 1, further comprising associating at least one donor substrate of the first material on the first substrate and thinning the at least one associated donor substrate to provide the arranged and associated layer segments.

8. The method of claim 7, further comprising:

forming a region of weakness in the donor substrate; and

detaching a layer segment from the associated donor substrate at the region of weakness to thin the donor substrate.

9. The method of claim 8, wherein the region of weakness is produced by forming a porous zone in the donor substrate.

10. The method of claim 8, wherein the region of weakness is formed by implanting atomic species into the donor substrate.

11. The method of claim 7, wherein the donor substrate is thinned by polishing or etching.

12. The method of claim 1, further comprising associating at least one of the layer segments with a second substrate, wherein the layer segments are arranged and associated with the first substrate while associated with the second substrate.

13. The method of claim 12, further comprising removing the second substrate from the layer segment when the segment is associated with the first substrate.

14. The method of claim 12, wherein the second substrate comprises silicon dioxide.

15. The method of claim 1, wherein the grown monocrystalline layer is grown by sublimation.

16. The method of claim 1, wherein the grown monocrystalline layer is grown by high temperature thick epitaxy.

17. The method of claim 1, wherein the first microcrystalline material comprises silicon carbide with a micropipe density of less than about 10 cm^{-2}.

18. The method of claim 1, wherein the first monocrystalline material comprises aluminum nitride or gallium nitride with a dislocation density of less than about 10^4 cm^{-2}.

19. The method of claim 1, wherein the first monocrystalline material comprises silicon carbide polytype 6H, 4H, or 3C.

20. The method of claim 1, wherein the grown layer is grown to provide a thickness of the grown monocrystalline material between about 50 μm and 10 mm.

21. The method of claim 1, wherein the first substrate comprises graphite.

22. The method of claim 1, wherein the thickness of the assembled layer is between about 0.1 μm and 1.5 μm.

23. The method of claim 1, wherein the arranged layer segments have a same crystal orientation.

24. A crystal made of monocrystalline material and encompassing a diameter of at least about 100 mm and a thickness of less than about 10 mm.

25. The crystal of claim 24, wherein the thickness is less than about 1 mm.

26. The crystal of claim 24, wherein the thickness is greater than about 100 μm.

27. The crystal of claim 24, wherein the monocrystalline material is silicon carbide with a micropipe density of less than about 1 cm^{-2}.

28. The crystal of claim 24, in which the monocrystalline material is silicon carbide polytype 6H, 4H, or 3C.

29. The crystal of claim 24, wherein the monocrystalline material is aluminum nitride or gallium nitride having a dislocation density is less than about 10^4 cm^{-2}.

30. A crystalline wafer, comprising:

a first substrate; and

an assembled layer comprising a plurality of layer segments arranged and associated with the first substrate in a same crystal orientation for growing thereon a layer of monocrystalline material.

31. The wafer of claim 30, wherein the layer segments comprise silicon carbide, aluminum nitride, gallium nitride, aluminum gallium nitride, or indium gallium nitride.

32. The wafer of claim 30, further comprising a grown layer of monocrystalline material grown on the assembled layer.